



# QuickTime MPEG-4 Technical Overview

**Session 607**





# QuickTime MPEG-4 Technical Overview

**Jesse Hammons**  
**QuickTime Engineering Team**

# What You Will Learn

- What is MPEG-4?
- MPEG-4 integration in QuickTime
- Using MPEG-4 in your application



# Meet the MPEG Family

- Standardized
  - MPEG-1, MPEG-2, MPEG-4
- In Progress
  - MPEG-7, MPEG-21
- Multimedia Technology Focus
  - Systems
  - Audio
  - Video



# MPEG-1 Goals

**MPEG-1**

**Enterprise Streaming**

**Video CDs**

**MP3 Audio**



# MPEG-2 Goals

## **MPEG-2**

**Broadcasting  
DVD/Home Theater**

## **MPEG-1**

**Enterprise Streaming  
Video CDs  
MP3 Audio**



# MPEG-4 Goals

## **MPEG-4**

**Internet Streaming  
Consumer Electronics  
Wireless Multimedia  
Hand Held Devices  
Media Databases**

## **MPEG-2**

**Broadcasting  
DVD/Home Theater**

## **MPEG-1**

**Enterprise Streaming  
Video CDs  
MP3 Audio**



# MPEG-4 Is...

- File format
- Video codecs
- Audio codecs
- Data transport
- and more...





# MPEG-4 Technologies

**Scene Description**

**Interactivity**

**Synchronization**

**MPEG - J  
(Java)**

**Audio**  
General  
Speech  
Synthetic Speech  
Synthetic Audio

**Visual**  
Video  
Still Images  
Text  
2D Graphic  
3D Graphic  
Face and Body Animation

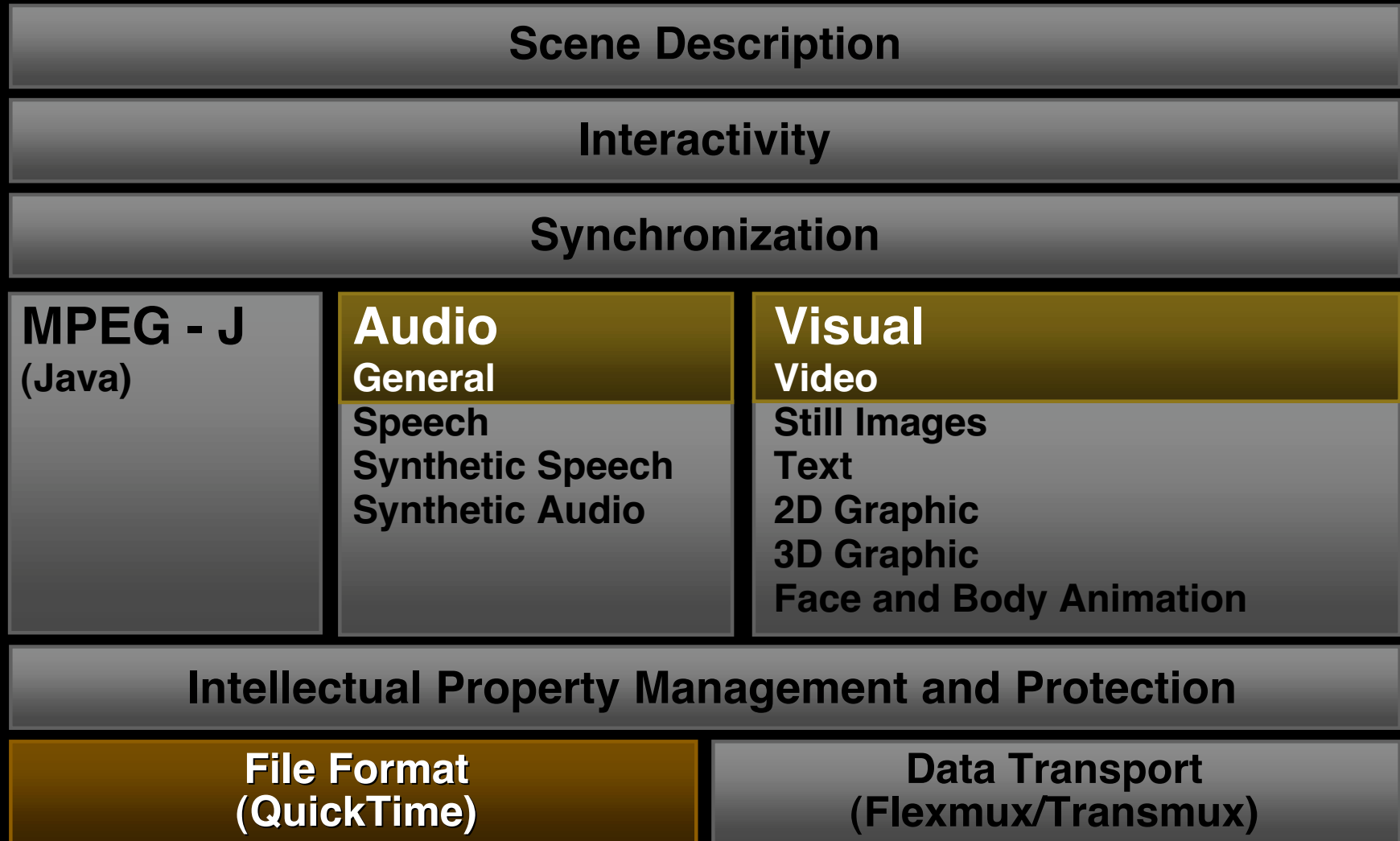
**Intellectual Property Management and Protection**

**File Format  
(QuickTime)**

**Data Transport  
(Flexmux/Transmux)**



# QT MPEG-4 Technologies



# MPEG-4 in QuickTime 6

- MP4 File format
- Video codec
- AAC audio
- RTSP/RTP streaming



# MPEG-4 Adoption

## Industry standards and consortiums

- ISMA
- 3GPP
- M4IF
- JPEG2000



# Profiles? Levels?

- Enable partial implementations of a standard
- Profiles define a subset of technologies
- Levels restrict computational complexity within a profile





Demo

# QuickTime Integration

- Import MP4 files
- Export MP4 files
- Stream MPEG-4 Video and Audio
- Encode MPEG-4 Video and Audio
- Play MPEG-4 Video and Audio



# Movie Export

```
err = ConvertMovieToFile(yourMovie,  
    ... ,  
    showUserSettingsDialog,  
    ...);
```





# Exporting Direct to .mp4

```
ci = OpenDefaultComponent  
    (MovieExportType, kQTFileTypeMP4);  
err = MovieExportDoUserDialog(  
    ci,  
    yourMovie,  
    nil,          /* all tracks */  
    startTime,  
    GetMovieDuration(yourMovie),  
    &canceled);  
err = MovieExportToXXX(ci, ...)
```



# Based on QuickTime?

## What does that mean?

- File format is based on QuickTime file format
  - QuickTime hint track
  - Atom-based
  - Subtle differences between the two file formats



# Let QuickTime Do It for You

- Call **NewMovieFromXXX()**—QT will manage the differences transparently
- QuickTime MP4 exporter will convert .mov files to .mp4 files

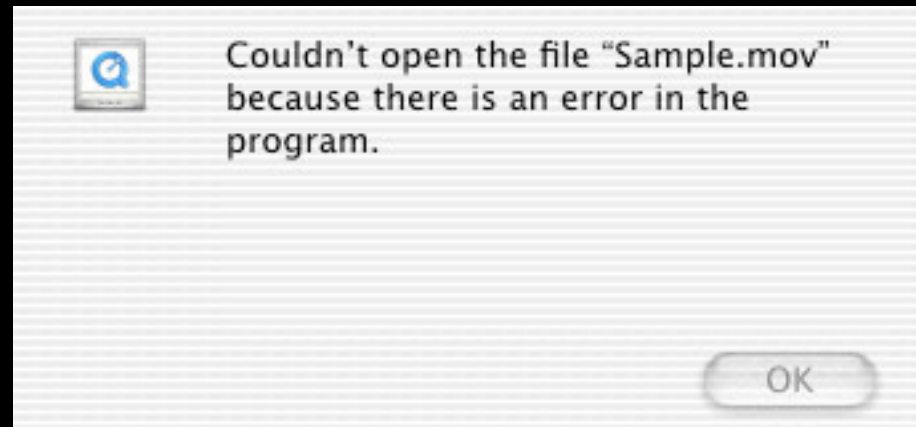


# Streaming Specifics

- Implemented as standard hint tracks
- RTP/RTSP streaming
  - Implemented as Packetizers and Reassemblers
  - Video: RFC 3016
  - Audio: draft-ietf-avt-mpeg4-simple-02.txt
- QTSS 4.0 streams hinted .mp4 files



# Error Handling





Demo

# New Warning Messages

- Use **NewMovieFromXXX()**
- Application can prevent this dialog with a new flag
- E.g., **NewMovieFromFile(&movie, resRefNum, NULL, NULL, **newMovieDontInteractWithUser** | newMovieDontAskUnresolvedDataRefs, NULL)**





# QuickTime MPEG-4 Video

**Roger Kumar**  
**QuickTime Engineering Team**



# Video Profiles and Levels

- MPEG-4 Video is scalable for use in many different situations
- MPEG-4 Video profiles and levels are designed for content delivery to specific markets
  - ISMA
  - 3GPP



# MPEG-4 Video Simple Profile

- Video at 50 kbps—4 Mbps
  - Streaming
  - Delivery to wireless handhelds
  - Stored content
  - Kiosk applications
  - Set-top boxes



# QuickTime MPEG-4 Video

- Implements MPEG-4 Video Simple Profile
- Decodes most ISMA and 3GPP streams
  - Displays detailed warning if it can not open a particular stream
- Encodes ISMA or 3GPP compliant streams



# Profiles and Levels Defined

- ISMA Profile 0
  - MPEG-4 Video Simple Profile
  - 176x144 at 15 fps and 64 kbps
- ISMA Profile 1
  - Simple or Advanced Simple Profile
  - 352x288 at 30 fps and 1.5 Mbps
- 3GPP
  - Similar to ISMA Profile 0
  - Designed for wireless handhelds



# System Requirements

- Playback requirements
  - ISMA P0 requires a 233 MHz G3 (or Pentium equivalent)
  - 500 MHz TiBook decodes 640x480 at 24 fps
- Encoding recommendations
  - PowerMac G4
  - 500 MHz TiBook encodes 320x240 at 24 fps in real-time



# Optimized Paths in QT

- Optimized for Velocity Engine
- Fast option for real-time encoding
- DV to MPEG-4 is optimized
- High-quality options for offline use
- Color and gamma correction



# Color Space

- MPEG-4 Video Codec supports RGB and YUV pixel formats
- RGB is widely supported in QT
  - Works with any QT movie
  - Using RGB can be inefficient
- YUV format is Y'CrCb
  - Implemented by DV, JPEG, MPEG-2, and MPEG-4
  - Best format for high-quality, efficient video processing



# Gamma Correction

- MPEG-4 Video stores gamma and color space information
- Video codec performs per-platform gamma correction
- MPEG-4 files will look the same on Mac and Windows





# No Gamma Correction



**Mac**



**Windows**



# Gamma Correction

- The MPEG-4 Video codec performs gamma correction for you



**Mac**



**Windows**





Demo

# Points to Remember

- MPEG-4 files import automatically
- Use standard QT export calls to get MPEG-4 export
- MPEG-4 codecs behave like other QuickTime codecs



# QT MPEG-4 Video Codec Summary

- QuickTime implements MPEG-4 Video Simple Profile and most of Advanced Simple Profile
- Compliant with ISMA, 3GPP and others
- Optimized for video processing in QT





# QuickTime MPEG-4 Audio

**Eric M. Aldrich I**  
**Core Audio**

# MPEG-4 Audio

- Multiple audio codecs
  - AAC (general audio)
  - CELP (speech)
  - TwinVQ (general audio)
  - HVXC (low bitrate speech)
  - and more...



# What Is AAC

- Perceptual audio codec
- Multichannel capable
- “Indistinguishable” audio quality
  - From CD Source:
    - AAC Low Complexity requires 96 kbps per channel
    - MP3 requires at least 128 kbps per channel!





# QuickTime AAC Encoder

- AAC-Low Complexity
- Acceptable source
  - 44.1 kHz or 48 kHz
  - Mono or stereo
- Output
  - Mono: 8 to 256 kbps
  - Stereo: 16 to 320 kbps
  - Sample rate automatically scaled to bit rate



# QuickTime AAC Decoder

- AAC Low Complexity
  - 8 to 320 kbps
  - 8 to 48 kHz
  - Mono or stereo
- ISMA Profile 0, 1 compliant

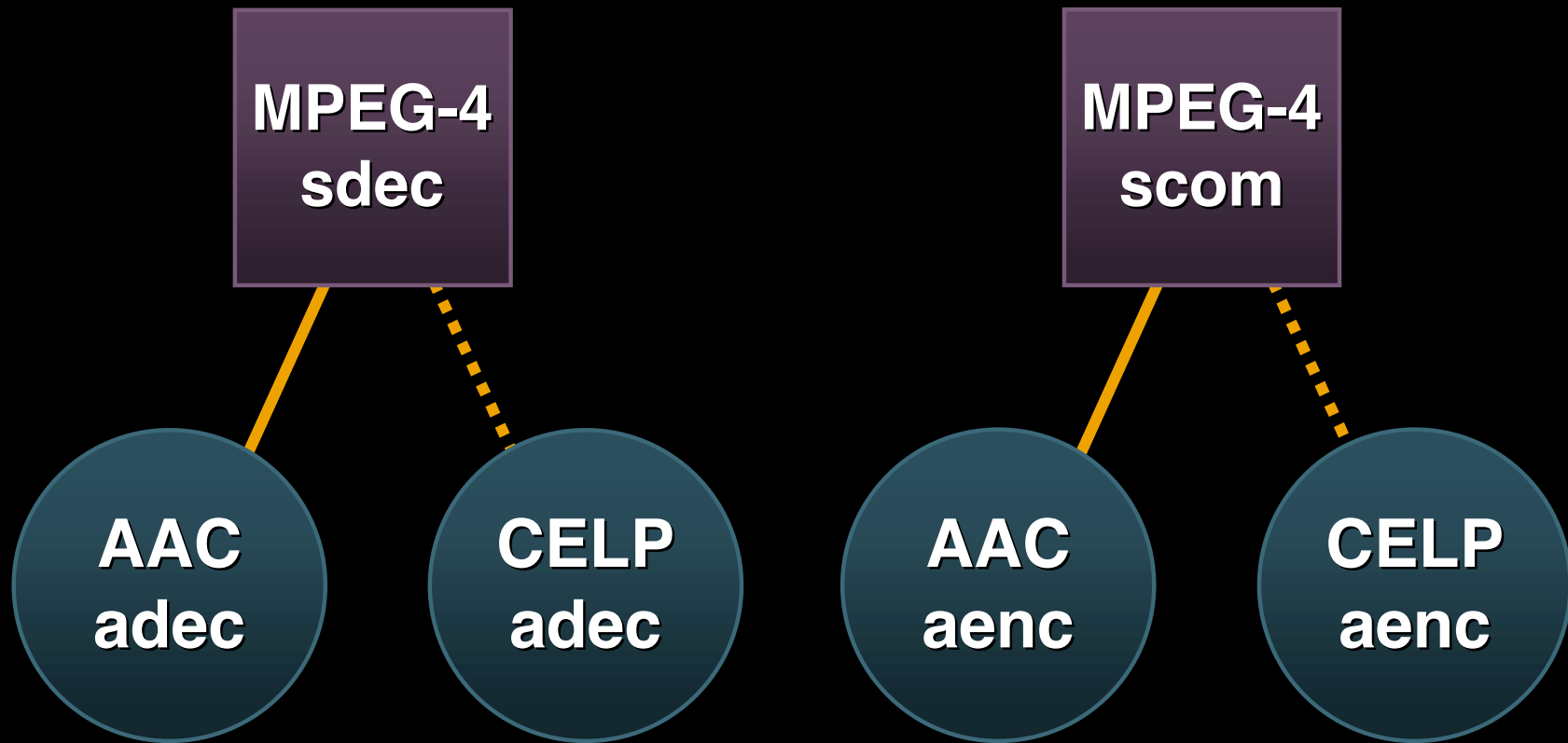


# New Audio Codec Architecture

- Allows for push-pull model at the codec level
  - Common audio codec implementation
- In QuickTime:
  - Allows multiple codecs to be chosen from one 'umbrella' component
  - Currently implemented only for MPEG-4 audio in QT 6



# QT Audio Components



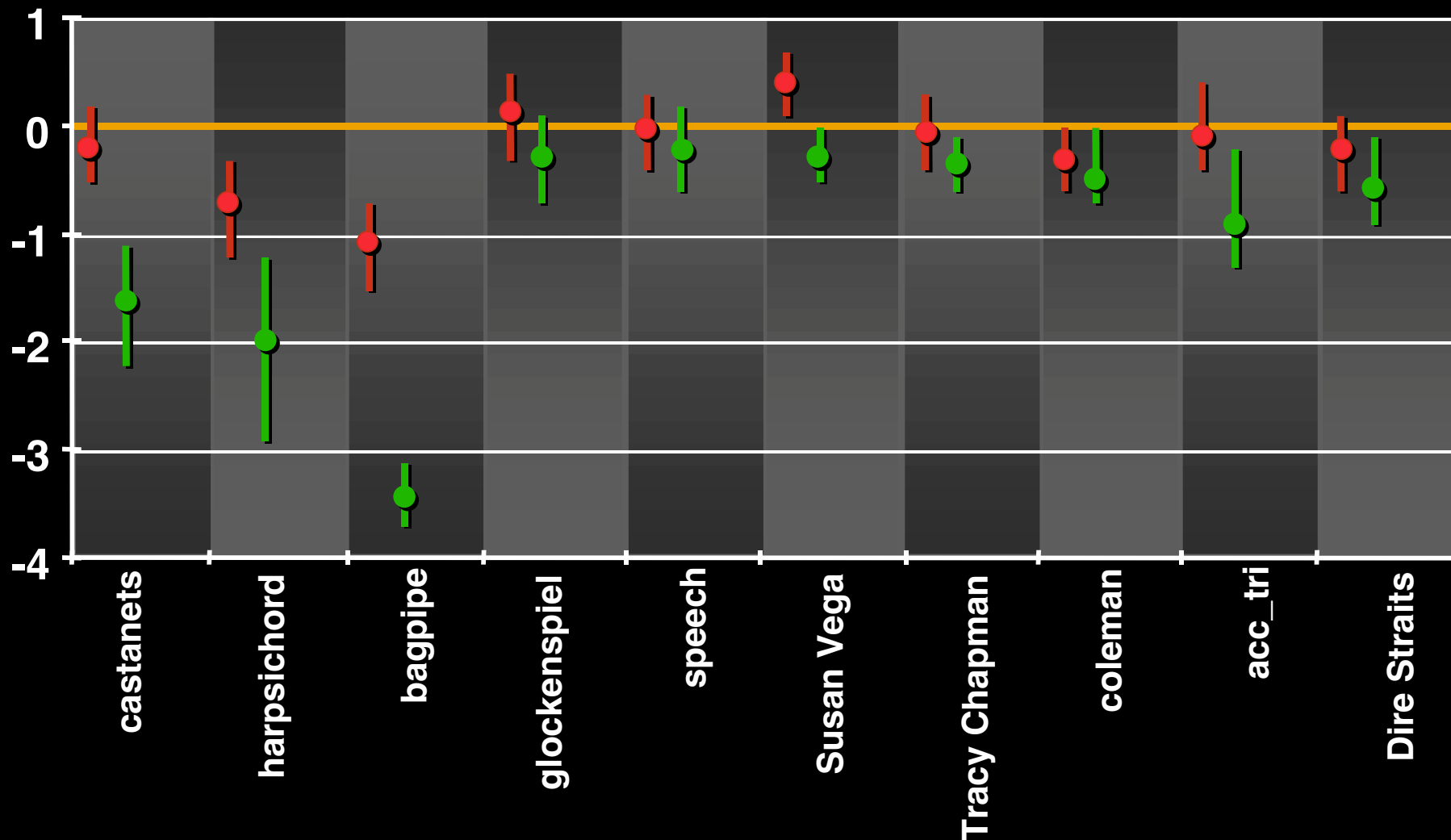
# AAC-LC vs. MP3

## Dolby Labs Evaluation

- Hidden reference, double blind test
- Trained audio professionals grade test files against unknown source



# AAC-LC vs. MP3 Results





Demo

# QuickTime AAC Recap

- High-quality audio codec
- Available in QuickTime 6
- Used in .mov and .mp4







# QuickTime MPEG-4 Summary

**Jesse Hammons**  
**QuickTime Engineering**

# MPEG-4 Gives You:

- A wider audience
- Interoperability opportunities
- High-quality video codec
  - Enhanced processing in QuickTime
- High-quality audio codec



# Jaguar Preview

- Jaguar Seed CD
  - Latest QuickTime and SDK
  - MPEG-4 Import and Export
  - MPEG-4 Video and Audio Codecs
  - Go Pro with your 5.0 key
- Jaguar Server Seed CD adds
  - QuickTime Streaming Server
  - QuickTime Broadcaster



# MPEG-4 Summary

- Rapidly emerging standard with wide industry support
- QuickTime's latest audio and video codecs
- QuickTime applications are now MPEG-4 applications



# Who to Contact

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## QuickTime Developer Relations

<http://developer.apple.com/quicktime>

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## QuickTime Developer Seeding

<http://developer.apple.com/seeding/>

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## Jeff Lowe

QuickTime Evangelist  
[jefflowe@apple.com](mailto:jefflowe@apple.com)

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<http://developer.apple.com/wwdc2002/urls.html>



# For More Information

- QuickTime 6 SDK  
<http://developer.apple.com/quicktime>
- Audio SDK  
<http://developer.apple.com/audio>
- ISMA  
<http://www.isma.tv>



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